

SCREW HOLDER

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of International Application No.

- 5 PCT/CH98/00425, filed October 5, 1998, the disclosure of which is hereby incorporated herein by express reference thereto.

FIELD OF THE INVENTION

- 10 This invention is directed to screw holder having a longitudinal shank and a central axis, a spindle located at the front end of the shank, concentric to the central axis, with a bore therethrough and a groove for receiving an elastic component, preferably, a spring, to secure a screw, particularly a bone or pedicle screw. The screw holder can be used during minimally invasive surgery.

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BACKGROUND OF THE INVENTION

- 20 To lessen the damage to soft parts around bone while surgically implanting a screw inside the body, typically to a bone, joint, or vertebra, the procedure should be carried out without uncovering large areas of the parts to be treated, *i.e.*, smaller incisions and less invasive surgery techniques. The use of clamping tongs to insert bone or pedicle screws is no longer suitable when employing minimally invasive surgery techniques.

- 25 European Patent No. 458,449 of Ryder discloses a fastener drive tool for applying a rotational torque to a threaded fastener for driving the fastener into or out of a workpiece. The drive tool has an elongated shaft portion with a free end that is engageable with a recess formed in the fastener. The drive tool has at least one interlobular fastener retention piece attached between two convex partially-cylindrical surfaces that engage a corresponding convex partially-cylindrical surface formed in the fastener recess. The interlobular fastener retention piece retains the fastener on the drive tool when the drive tool is engaged with the fastener recess and prevents wobbling of the fastener when driven by the drive tool, but requires a significant portion of the surface and, therefore, can weaken the cross-section of the shaft, particularly when using smaller screws.

- 30 A need exists for a type of screw holder adapted for surgical use. Palliation is a key feature in the design of any surgical tool. A screw holder that might ease the pain typically associated with implantation of a screw into the body, without losing the positive benefits of the surgery, would be beneficial in the art. The present invention aims at solving this need in the art by configuring a screw holder to hold a bone or pedicle screw while being turned in or out.

SUMMARY OF THE INVENTION

The present invention is directed to a device for securing a screw including: a longitudinal shank having a central axis and rear and front ends; a spindle, located at the front end of the longitudinal shank concentric to the central axis, having front and rear ends, a substantially polygonal-shaped cross-section with a plurality of rounded edges and a plurality of concave side surfaces, a groove substantially parallel to the central axis, and a borehole flush with the groove concentric to the central axis; and an elastic component having top and bottom ends, with the bottom end inserted into the borehole and the top end inserted into the groove. Preferably, the shank has a first diameter and the spindle has a second diameter less than the first diameter. The spindle preferably has a hexagonal shape. The elastic component projects transversely to the central axis across the cross-section when unstressed. The spindle is received into a screwhead aperture of the screw, and the screw is secured into position upon stress to the elastic component.

In one embodiment, the rear end of the longitudinal shank is configured and dimensioned to be received into a motor-driven screwdriver. In another embodiment, the rear end of the longitudinal shank is configured and dimensioned to be received by a screwdriver.

In one embodiment, the groove and the borehole are flush with one of the plurality of rounded edges. In another embodiment, the groove and the borehole are flush with one of the plurality of concave side surfaces.

The elastic component can preferably bend elastically substantially perpendicular to the central axis. In one embodiment, the top end of the elastic component is fixed in the groove. In a preferred embodiment, the top end of the elastic component is bonded, soldered, or clamped into the groove. In yet another embodiment, the elastic component is a spring wire, preferably having a width of 2 mm.

The invention is also directed to a method of securing a screw while implanting into a body including: providing a screw having an aperture in a screwhead; providing the device described above; and inserting the spindle into the aperture resulting in stress to the elastic component, wherein upon application of the stress, the elastic component holds the screw in a steady position.

In one embodiment, the screw is a bone or pedicle screw. In another embodiment, the groove and the borehole are flush with one of the plurality of rounded edges. In yet another embodiment, the groove and the borehole are flush with one of the plurality of concave side surfaces.

The elastic component can preferably bend elastically substantially perpendicular to the central axis. In one embodiment, the top end of the elastic component

is fixed in the groove, preferably bonded, soldered, or clamped into the groove. The elastic component is preferably a spring wire.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Further features and advantages of the invention can be ascertained from the following detailed description which is provided in connection with the attached drawings, wherein:

FIG. 1 is a sideview according to one embodiment of the invention;
FIG. 2 is a front view according to one embodiment of the invention;
10 FIG. 3 is a partial section according to the embodiment of the invention shown in FIG. 2.
FIG. 4 is a front view according to another embodiment of the invention; and
FIG. 5 is a partial section according to the embodiment of the invention
15 shown in FIG. 4.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a screw holder for securing a bone or pedicle screw, whether being turned in or out, during surgery. The main advantage of the screw
20 holder is that it eliminates the need for the traditionally used clamping tongs and focuses on minimally invasive surgery techniques to reduce the damage to the soft parts around bone while implanting such a screw.

In one embodiment, shown in FIG. 1, a screw holder 7 includes a cylindrical
25 shank 1 having a central axis 5, a rear end 2 and a front end 21. An affixation means 13 is configured concentrically with the central axis 5 at the rear end 2 of the screw holder 7, allowing the screw holder 7 to be used in a motor-driven screwdriver (not shown). The screw holder can also be handled manually. A spindle 4, concentric with the central axis 5,
30 is present at the front end 21 of the screw holder 7. The diameter of the spindle 4 is less than the diameter of the cylindrical shank 1 resulting in a shoulder 3 formed at the front end 21 of the cylindrical shank 1.

The spindle 4 has a cross-section 8, shown in FIG. 2, configured so that the spindle 4 is insertable into the aperture 14 of a screwhead 16. As a result, a screw 15
35 is clamped by the spring 9, shown in FIG. 3, against the spindle 4. The spindle 4 is removed from the aperture 14 upon completion of the procedure.

FIGS. 2 and 3 show an enlargement view of the spindle 4. The spindle includes a front end 6 and a rear end 12, with the rear end 12 adjoining the shoulder 3 formed at the front end 21 of the cylindrical shank 1.

The screw holder spindle can have various cross-sectional shapes, *e.g.*, a hexagonal socket. The spindle 4 preferably has a relatively polygonal-shaped cross-section 8. The polygon corners 10 are rounded and the sides are concave, resulting in rounded edges 20 parallel to the central axis 5. The side surfaces 11 of the spindle 4 are concave and run parallel to the central axis 5. A groove 17 runs parallel to the central axis 5 along one of the concave side surfaces 11. A borehole 18 also runs parallel to the central axis 5 flush with the groove 17 and is configured and dimensioned for receiving a spring 9, thus allowing for a reversible means to secure or clamp the screw while being turned in or out.

The spring 9 may be a leaf spring or another suitable elastic element capable of being adapted for the small diameter of the spindle. In a preferred embodiment, the spring may be a simple spring wire less than 2 mm, and optionally, the spring may be bent. The spring 9 has a clamped part 22 to be located inside the borehole 18; the top part 23, optionally bent, of the spring 9 runs in the groove 17 and projects across the side surface 11 of the spindle 4 transversely to the central axis 5.

The part of the spring 9 providing a means for screw retention 23, in one embodiment being the bent, may be bonded, soldered, or clamped into the groove 17 or 19.

The second embodiment of the invention, shown in FIGS. 4 and 5, relates to the screw holder as described above, with different placement of the groove and borehole for receiving the spring. Groove 19 and borehole 18 are flush along edge 20 of the spindle 4.

It is to be understood that the invention is not to be limited to the exact configuration as illustrated and described herein. For example, the screw holder of the invention may be implemented in various designs using a spring inserted into a groove. The two embodiments discussed in the Detailed Description of the Invention, wherein the groove may be present in an edge of the cross-sectionally polygonal spindle or it may be present in a lateral spindle surface running parallel to the longitudinal axis, are not intended to limit the invention. Accordingly, all expedient modifications readily attainable by one of ordinary skill in the art from the disclosure set forth herein, or by routine experimentation therefrom, are deemed to be within the spirit and scope of the invention as defined by the appended claims.